STAT 1350, 3/31 Discussion Questions

Suppose we need to flip a coin, but we don't have one. However, we do have a random number table that we could use.

6. To simulate the outcome of tossing a coin you could assign random digits as follows:
   A) one digit simulates one toss; even digits are heads, and odd digits are tails. ok
   B) one digit simulates one toss; 0, 1, 2, 3, 4 are heads, and 5, 6, 7, 8, 9 are tails. ok
   C) one digit simulates one toss; 0, 1, 4, 6, 9 are heads, and 2, 3, 5, 7, 8 are tails. ok
   D) two digits simulate one toss; 00 to 49 are heads, and 50 to 99 are tails. ok
   E) Any of (A), (B), (C), (D) would work.
   F) Can you think of another way?

7. I want to use simulation to estimate the probability of getting exactly one head and one tail in two tosses of a fair coin. I assign the digits 0, 1, 2, 3, 4 to heads and 5, 6, 7, 8, 9 to tails. Using the following random digits to simulate, what is the estimate of the probability?

Trial #1:	19226 95034 05756 07118	HTHHT TTHHH HTTTT HTHHT	$\frac{10}{20} = 50\%$
Trial #2:	40580 96418 73381 23112	HHTTH TTHHT THHTH HHHHH	$\frac{13}{20} = 65\%$
Trail #3:	04399 19875 33936 25250	HHHTT HTTTT HHTHT HTHTH	$\frac{10}{20} = 50\%$

In a small Colombian village, 20% of the adults own a car, and 75% of the adults attend church regularly.

8. What is the probability that a randomly selected adult from this village owns a car and attends church regularly?

   $.2 * .75 = .15$ 15%

9. What is the probability that a randomly selected adult from this village does not own a car and does not attend church regularly?

   $.8 * .25 = .20$ 20%

10. What is the probability that a randomly selected adult from this village owns a car but does not attend church regularly?

    $.20 * .25 = .05$ 5%

11. Suppose you toss a fair coin twenty-six times and each time you observe heads (i.e., 26 heads in a row). What is the probability of heads on your next toss?

    $1/2$ or 50%

12. Below is a table of observations from a sample of college students. Find the probability of a student who works less than 30 hours per week, but still has a credit card. Describe a method of simulating these results.

	Students with a Credit Card	Students without a Credit Card
Students who Work (>30 hrs/wk)	271 ①	255 ③
Students who Work (<30 hrs/wk)	143 ②	331 ④

$\frac{143}{1000} = .143$ or 14.3%

Let 000–270 be Category ①, 271–413 be ②, 414–668 be ③ and 669–999 be ④

STAT 1350, 4/2 Discussion Questions

1. Suppose you know the percentage of foul shots a basketball player makes during the season. You want to estimate the expected number of shots made in 10 shots. You simulate 10 shots 25 times and get the following numbers of shots made:

   7 9 7 6 3 7 5 6 5 6 7 5 6 6 8 5 6 3 9 6 7 7 8 7 9

   Your estimate is: 6.4

2. Choose an American household at random and ask how many computers that household owns. Here are the probabilities as of 2009:

Number of computers	0	1	2	3	4	5
Probability	0.241	0.412	0.214	0.083	0.032	0.018

   What is the expected number of computers owned by a randomly chosen household?

$$0(.241) + 1(.412) + 2(.214) + 3(.083) + 4(.032) + 5(.018)$$

$$1.307$$

A game involving a pair of dice pays you $4 with probability 16/36, costs you $2 with probability 14/36, and costs you $6 with probability 6/36.

3. What is your expected net result, in dollars, per play?

$$4\left(\tfrac{16}{36}\right) - 2\left(\tfrac{14}{36}\right) - 6\left(\tfrac{6}{36}\right) = 0$$

   Fill in the expected value table (the probability distribution) below:

Value	4	-2	-6
Probability	16/36	14/36	6/36

4. If you play this game many times, in the long run how will your actual average gain per play compare with your answer to the previous question?

   net gain should be approximately zero

5. A standard deck of cards contains 52 cards, of which 4 are aces. You are offered the following wager: draw one card at random from the deck. You win $10 if the card drawn is an ace. Otherwise, you lose $1. If you make this wager very many times, what will be the mean outcome?

Fill in the expected value table (the probability distribution) below:

Value	10	-1
Probability	4/52	48/52

$10(4/52) - 1(48/52) = \frac{40-48}{52} = \frac{-8}{52} \approx -.15$

A multiple choice exam offers four choices for each question. Paul just guesses the answers, so he has probability 1/4 of getting any one answer right.

6. Paul's guess on any one question gives no information about his guess on any other question. The statistical term for this is independent

7. What is the expected number of right answers Paul will get if the test has 20 questions?

$20 * \frac{1}{4} = 5$

8. Kevin thinks he can use ESP to predict the outcome of rolling a fair die. You agree to pay him $3 if he can correctly predict the results of the next roll. Kevin has to pay you $1 if he is wrong. If Kevin doesn't have any psychic powers, which of the following is closest to the expected value of your net winnings on this bet?

$3(1/6) - 1(5/6) = -.33$ $(-1/3)$ from Kevin's view

Fill in the expected value table (the probability distribution) below:

Value	3	-1
Probability	1/6	5/6

1/4 four to match probability table below

9. A multiple-choice exam offers five choices for each question. Jason just guesses the answers, so he has probability 1/5 of getting any one answer right. One of your math major friends tells you that the assignment of probabilities to the number of questions Jason gets right out of 10 is (rounded to three decimal places):

Number right	0	1	2	3	4	5	6	7	8	9	10
Probability	0.056	0.188	0.282	0.250	0.146	0.058	0.016	0.003	0.000	0.000	0.000

What is the expected number of right answers Jason will get if the test has 10 questions?

$1/4 * 10 = 2.5$

using rounded values from table, you get about 2.495

10. One way of thinking about expected values is as a weighted average. Suppose that you have 74% on exams worth 60% of your final course grade, 91% on homework worth 20% of your course grade, and 86% on labs worth 10% of your course grade, and 68% on quizzes worth 10% of your course grade. What is the weighted average for the course, and what grade do you expect to receive with these marks? Build an expected value table.

$$74(.60) + 91(.20) + 86(.10) + 68(.10) = 78$$

Value	74	91	86	68
Weight	.60	.20	.10	.10